

A further contribution to the systematics of Southern African anuran tadpoles—the genus *Bufo*

by

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SYNOPSIS

A key to tadpoles of most of the Southern African *Bufo* species at about the earliest 5-toed stage is presented. The taxa covered are *B. rosei*, *B. angusticeps*, *B. amatolica*, *B. gariensis nubicola*, *B. rangeri*, *B. pardalis*, *B. regularis*, *B. garmani*, *B. vertebralis vertebralis* and *B. vertebralis hoeschi*. Taxa remaining to be identified are *B. pusillus* and (from restricted northern areas) *B. ngamiensis*, *B. anotis* and *B. taitanus beiranus*.

In an earlier paper on Southern African Anuran tadpoles (Van Dijk, 1966) it was found necessary to leave a key to the Bufonidae in abeyance, except for *Schismaderma carens* (*Bufo carens*) and *Bufo rosei*. Tadpoles of *B. rosei*, *B. gariensis nubicola*, *B. vertebralis vertebralis* and *B. amatolica* in a collection purchased by the Natal Museum, specimens of *B. angusticeps* from the Zoological Institute, Stellenbosch, and specimens of tadpoles collected and tentatively identified by Mr. John Visser as *B. pardalis*, together with tadpoles collected by the author, have now made it possible to construct a key to all species of *Bufo* occurring in Southern Africa except *B. pusillus* and those known only from restricted areas of Botswana, Rhodesia and Mozambique (*B. ngamiensis*, *B. anotis* and *B. taitanus beiranus*). The available material of all taxa was adequate since the only two taxa of which limited numbers were available, *B. amatolica* and *B. vertebralis vertebralis*, had some particularly clear-cut diagnostic characteristics. It is possible that large samples of the various taxa or specimens from widely separated localities may show sufficient variation to cause overlap in the characteristics used in the key, but it is improbable that more than a small proportion of specimens will fail to key out correctly. Extensive studies of variability would best follow description of *B. pusillus* and of the remaining subspecies of *Bufo vertebralis* and *B. gariensis*. (See comment on priorities, op. cit., p. 262.)

The key refers to tadpoles approximately at the earliest 5-toed stage (Stage 55 of the *Xenopus* Normal Table). The terminology used is that used in the 1966 tadpole paper cited (see fig. 1).

Key to tadpoles of Southern African *Bufo* species

1. Tail more than twice as long as the rest of the body, tail nearly uniformly deep along its length (i.e. dorsal and ventral fin margins nearly parallel) with tip bluntly rounded. Egg-strings single and beaded **B. rosei**
- Tail less than twice as long as the rest of the body 2

2. Tail nearly uniformly deep along its length (i.e. dorsal and ventral fin margins nearly parallel) with tip bluntly rounded and/or rostrodont margins deeply edged with pigment 3
- Tail margin with distinct convex curvature ventrally as well as dorsally, tapered over more than $\frac{1}{4}$ of the tail length to a rounded tip and/or tail less than $1\frac{1}{2}$ times as long as the rest of the body and eye to nostril distance greater than eye length 4
3. Margin of rostrodonts not deeply edged with pigment (depth on infrarostrodont $\frac{1}{8}$ th or less of chord width of infrarostrodont); nostrils smaller than lens of eye, median projection of nostril margin slight **B. angusticeps**
- Margin of rostrodonts moderately deeply edged with pigment (depth on infrarostrodont $\frac{1}{4}$ or more of chord width of infrarostrodont); nostrils considerably larger than lens of eye (*circa* $\frac{1}{2}$ as large as eye), median projection of nostril margin prominent
- B. gariepensis** (*B.g. nubicola*, ? *B.g. gariepensis*)
4. Eye to nostril distance greater than eye length **B. amatolica**
- Eye to nostril distance less than eye length 5
5. Pigmentation over caudal muscles anteriorly confined to upper $\frac{2}{3}$ 6
- Pigmentation over caudal muscles not anteriorly confined to upper $\frac{2}{3}$ (covers more than $\frac{3}{4}$ and sparse pigment typically extends almost to the ventral margins) 7

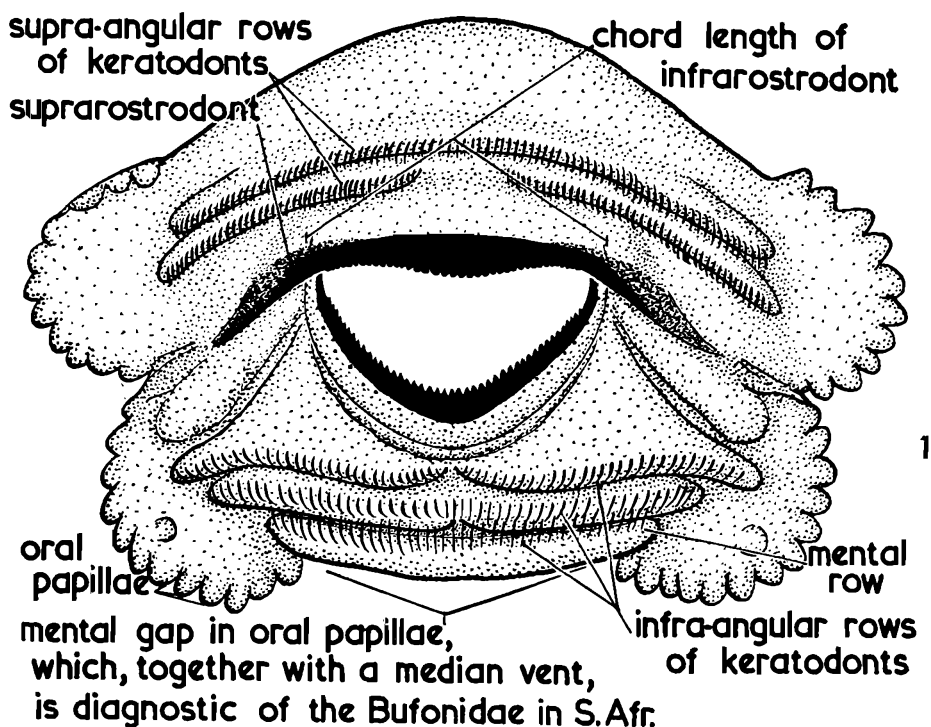


Fig. 1.

6. Pigmentation over caudal muscles confined to upper $\frac{2}{3}$ of the muscles almost to the tip of the tail (fig. 2); more than 1 papilla on each side ventrolaterally within the oral disc **B. rangeri**
- Pigmentation over caudal muscles covers the muscles posteriorly (in side view reaches the ventral limits over approximately posterior $\frac{1}{3}$); one papilla or none on each side ventrolaterally within the oral disc **B. pardalis**
7. Pigmentation (melanophores) extends transversely across the gular region, at least posteriorly, and/or nostrils less than $\frac{1}{2}$ length of eye 8
- Pigmentation (melanophores) does not extend transversely across the gular region, and/or nostrils more than $\frac{1}{2}$ length of eye 9
8. Pigmentation (melanophores) extends transversely across the gular region anteriorly (somewhat more sparsely) as well as posteriorly, lining of abdominal cavity more or less uniformly and densely pigmented with melanophores, ventrally covered more or less completely by superficial iridiophores (light and shiny pigment cells which tend to become transparent in preserved material) **B. garmani**
- Pigmentation (melanophores) does not extend transversely across the gular region anteriorly, median region of abdominal cavity between the abdominal muscle strands with little pigmentation **B. regularis**
9. Nostril length more than $\frac{1}{2}$ length of eye; mental row of keratodonts short (length typically less than width of infrarostrodont and $\frac{1}{2}$ as long as row proximal to it) **B. vertebralis vertebralis**
- Nostril length less than $\frac{1}{2}$ length of eye; mental row of keratodonts ranging from short (length somewhat greater than width of infrarostrodont) to long (length somewhat greater than width of suprarostrodont) **B. vertebralis hoeschi**

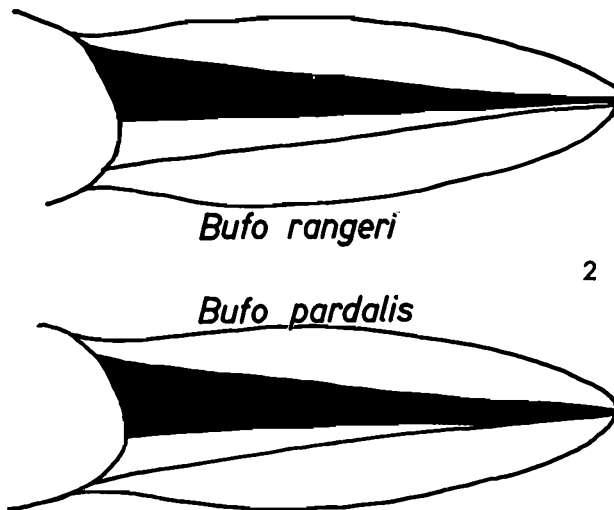


Fig. 2

LOCALITIES OF SPECIMENS ON WHICH THE KEY IS BASED

Localities of key specimens	Taxa considered in the key									
	<i>B. rosei</i>	<i>B. angusticeps</i>	<i>B. amatolica</i>	<i>B. gariepensis</i>	<i>B. rangeri</i>	<i>B. pardalis</i>	<i>B. garmani</i>	<i>B. regularis</i>	<i>B. v. vertebralis</i>	<i>B. v. hoeschi</i>
Slopes of Table Mountain	†	— Cape Town and Suburbs	—	—	— Kalk Bay and Diep River	—	—	—	—	—
Stellenbosch	—	†	—	—	— Paarl and Sir Lowry Pass	— *	—	—	—	—
Hogsback	—	—	†	— Fort Brown	† (Wager) Grahamstown	— Grahamstown	—	—	—	—
Drakensberg at Giant's Castle	—	—	—	†	‡	—	—	‡	—	—
Pietermaritzburg ..	—	—	—	—	†	—	‡ (unpublished) Kwa-Mbonambi nearest record	†	—	—
Cape Flats	— Table Mt. Slopes	‡	—	—	— Paarl Sir Lowry Pass	†	—	—	—	—
Windhoek	—	—	—	—	—	—	†	—	—	‡
Bloemfontein	—	—	—	‡	‡	—	—	‡	†	—
Windhoek (Eros Mountains)	—	—	—	—	—	—	‡	—	—	†
Identified by:	Power & Rose (1929)	Zool. Institute Stellenbosch	V. Wager	V. Wager	D. E. van Dijk	J. Visser as ? <i>B. pardalis</i>	A. Channing & D. E. van Dijk	D. E. van Dijk	V. Wager	A. Channing & D. E. van Dijk
	Checked on Natal Museum specimens	Re-examined Accords with specimens checked by C. G. S. de Villiers	Re-examined	Re-examined	Checked on Natal Museum specimens	Specimens from Bettysbay and Swellendam also key out as <i>B. pardalis</i>		Checked on Natal Museum specimens	Re-examined	
Collections	Natal Museum Zool. Institute Stellenbosch	Natal Museum Zool. Institute Stellenbosch	Natal Museum	Natal Museum	Natal Museum	Natal Museum	Windhoek Museum	Natal Museum	Natal Museum	Windhoek Museum Natal Museum

† the Taxon under consideration, ‡ other Taxa recorded at the Key locality, — absent from the Key locality
 * De Villiers (Ann. Transvaal Mus. 13: 134, 1929) states, '*Bufo regularis*. This toad is much less common on the Stellenbosch flats than *B. angusticeps*'. This reference to *regularis* may be incorrect; the species probably was *rangeri* or *pardalis*. De Villiers' specimens are not available.

Care has been taken to ensure that the localities of the specimens of each species on which the key is based are such that confusion with other species is unlikely, as may be seen from the table. A trip was made to South West Africa specifically to collect *B. garmani* tadpoles, which were identified by the presence of adults and juveniles of only this species at the site of collection, by *B. garmani* alone being known to breed at the site (in Windhoek, near the Museum), and by their slow development when compared with the tadpoles identified as *B. vertebralis hoeschi*.

Tadpoles which key out as *B. rangeri* have not yet been found in the western Cape. The possibility that *B. rangeri* in this area would key out as *B. pardalis* can thus not yet be ruled out. Collections from the Dordrecht area would be useful as, besides *B. rangeri*, only *B. vertebralis vertebralis* and *B. gariensis gariensis* are recorded there and other *Bufo* species are unknown for some distance. The Smithfield–Colesberg area is similarly a good site for collecting *B. vertebralis vertebralis*.

The key has been so arranged as to allow *B. gariensis gariensis* to key out with *B. g. nubicola* if it agrees with *B. g. nubicola* in tail or rostrodont pigmentation characteristics. Similarly provision has been made for other subspecies of *B. vertebralis* to reach step 9. Provision has been made for *B. amatolica* to be identified regardless of its tail characteristics (except length). It should be noted that specimens not from the Amatola Mountains which key out as *B. amatolica* must be suspected of having been misidentified (*B. gariensis nubicola* has small eyes like *B. amatolica*, but a longer tail).

The construction of a key emphasizes characteristics which are apparently diagnostic, making it possible to give particular attention to these characteristics when tadpoles are described or illustrated. It is not surprising that descriptions or illustrations given without particular attention to the criteria chosen in the key, do not always agree with the key. Thus the illustrations of *B. rosei* tadpoles in W. Rose's *The Reptiles and Amphibians of Southern Africa* (Maskew Miller, Cape Town, 1962, p. 101) and V. Wager's *The Frogs of South Africa* (Purnell, Cape Town, 1965, p. 228) show the tail as less than twice as long as the rest of the body and twice as long respectively. Wager's illustration agrees with his measurements (p. 218), but Rose's do not agree with the measurements in Power & Rose (1929). Wager likewise gives average measurements of the tail of *B. gariensis nubicola* (p. 218) as being twice as long as the rest of the body, although examination of 50 specimens, known to have been seen by Wager, revealed that only one had a tail so nearly twice the length of the rest of the body that it could be considered to conform to the proportions given by him. (The tail, being very narrow from top to bottom, appears deceptively longer than measurements show it to be.) The importance of knowing what criteria to look at when describing tadpoles is illustrated by specimens of *B. rangeri* collected by Wager which key out correctly although he states (op. cit., p. 226): '*Bufo rangeri*. Eggs and tadpoles were obtained from mating pairs from the Drakensberg, Natal, and the Hogsback, Cape, where this species could not be confused with *B. regularis*: tadpoles of the two species were quite similar to one another.'

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REFERENCES

- POWER, J. H. & ROSE, W., 1929. Notes on the Habits and Life-Histories of Some Cape Peninsula Anura. *Trans. roy. Soc. S. Afr.* **17**: 109-115.
- VAN DIJK, D. E., 1966. Systematic and field keys to the families, genera and described species of Southern African Anuran tadpoles. *Ann. Natal Mus.* **18**: 231-286.

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